Changes in Danish Innovation Policy

responses to the challenges of a dynamic business environment

Christensen, Jesper Lindgaard

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Changes in Danish Innovation Policy - responses to the challenges of a dynamic business environment

Jesper L. Christensen
Department of Business Studies
Aalborg University
Fibigerstraede 4
9220 Aalborg Oest
Denmark
Email: jlc@business.auc.dk
Phone: +45 96 35 82 61
Fax: +45 98 15 60 13
Homepage: http://www.business.auc.dk/ike/members/jlc.html

1. Introduction[1]

As in other West-European countries Danish innovation policies has undergone significant changes during the past couple of decades. Moreover, it is perhaps one of the most important changes that innovation has gained much higher focus and priorities in the overall industrial policy. It is fair to say that even if the importance of technological development has been recognised since long, then innovation has now to a much larger extent become the buzzword of Danish industrial policies.

Promoting innovation through changing institutional structures and incentives is bounded by the institutional and political set-up this policy is to be implemented in. In other words, the historically rooted Danish mode of innovation provides an important trajectory for which policies that could be expected to be effective and efficient.

Policy changes are, however, not only a result of previous development, because this would require that all past political decisions were made on a completely well-informed basis in a world without different political interests. In practise, governments are unable to operate without failures, political conflicts and public debates may influence decisions, and the knowledge on the nature of the innovation process has improved immensely. Furthermore, governments learn from experiences on what works and what fails. Likewise the scope for efficient policy is bounded by the national industrial structure, norms and traditions for collaboration etc. Therefore, innovation policy is a much more demanding task than simply copying successful schemes from abroad. As a result, political strategies change over time in response to all these forces.

Following the argument above, to understand the development of innovation policy it is important to define the context in which is to operate, in other words, the special features of Danish innovation must be explained. This is done in section 2, following this introduction. The above-mentioned main changes in innovation policies are explained in section 3. Next, in section 4, it is discussed what are the present challenges for innovation policies. It is discussed what inspiration to these policies is, in particular to what extent academic research influence policy making. Measures to cope with these changes are exemplified in section 5. These examples are not chosen randomly but illustrate some important principles of policy making. Finally, section 6 summarises the main arguments of the paper and points to possible future policy developments.

2. Characteristics of a possible Danish mode of innovation

The headline of this section does, of course, exaggerate how far one can go in defining a uniform mode of innovation, which is characteristic for all Danish firms. In practise, firms differ in their objectives for innovation, in the sources of inspiration for innovation, in how radical the innovations are, in how benefits are appropriated etc. Nevertheless, it is possible to point to some general features of innovation in Denmark.

[1] I am grateful to Jens Nyholm, Mikkel B. Rasmussen, Peter Torstensen and Birgit Kjølbye of The Ministry of Industry for their time to participate in interviews on the issues in this article. The responsibility of the content is solely with the author, and opinions expressed are not necessarily shared by the Ministry of Industry.

This has been analysed in a large research project called DISKO (Danish Innovation System in KOmpartive perspective). The overall objective was to map the Danish innovation system and to enhance the understanding of the innovation processes in Danish firms[2]. This research has indeed inspired policy making as will be discussed later. The final report from the project (Lundvall, 1999) summarised the findings and put them in a broader perspective. With respect to a possible specific Danish mode of innovation it was pointed to, among others, the following features:

Based on data on the specialisation of Danish export and production the technological development in Denmark may be characterised as strongly specialised in low-technology products. There are some high technology fields in the Danish production for example in pharmaceuticals (dominated by NOVO) but generally the science-based industries make up a small share of the economy.

On the other hand Denmark is especially successful in the production and export of 'low' and 'low medium' technology goods. This includes food products, furniture and clothing. In addition, successful niche productions have been established in a number of areas like windmills, health care products, seed production and environmental technologies. Some of these areas have been stimulated or even started by public regulation or/and the welfare model of Denmark. Firms are generally good at absorbing and using technology including information technology and process optimisation. Incremental product development characterises both the high technology and the low technology firms.

In fact, there was an early recognition of the nature of the Danish technological development along the lines mentioned above. Thus, in a policy document from 1990 it was much emphasised as illustrated by the citation below (translation from Danish)

> "…for a country like Denmark it is of great importance, that new technology is introduced in the production process. Many so-called low-tech industries have survived on skill-full implementation of new technology in all phases of the production process, and this may improve competitiveness significantly. This type of technological development must not be under-estimated" (Industriministeriet, 1990, p.11)

In spite of this recognition the same document proceeds immediately after the passage quoted above with arguing how vital R&D is, and the policy recommendations derived are without exception targeted at enhancing R&D and the system for appropriation (ibid., p.12). This seems to be a paradox: it is emphasised that technological development is based on a wide range of innovative capabilities, not only science. Nevertheless, R&D-policies are advocated. Apparently the policy making is subject to a considerable inertia and lack of creativity. Moreover, the political will to make more targeted policies were generally lacking – something which changed shortly after, as we shall see in the next section.

Another feature of the Danish innovation system is the system for vocational and adult training. In Denmark this may be characterised as heavily targeted at upgrading general qualifications, at least the part of the training system which is publicly funded. The policy rationale is to improve labour market flexibility by upgrading general skills and to avoid free-rider behaviour of firms if the financing is private. However, the qualifications in need in the new business environment is to a large extent abilities to co-operation, communication etc., which may be argued to be learned most effi-

[2] See further details on the DISKO-project (1996-1999) on http://www.business.auc.dk/disko/.

ciently in the specific context in which the persons are expected to co-operate, that is the firm. It is consequently advocated by some observers that the training system should be adjusted towards a more firm specific model (Nyholm et al., 2001, p.264).

Changes in the vocational training system in the direction of a more firm specific model were also called for a decade ago (Industriministeriet, 1990, p.14). Changes in this direction have been small and slow. One of the reasons is probably an internal fight between ministries on what their resort area should be. On the other hand, over time the collaboration between ministries has generally improved in large as a consequence of pure necessity – innovations are increasingly complex and require different actors to take part.

Still another feature of the innovation system in Denmark is a high propensity to collaborate on innovation. Within firms there is a growing emphasis on the interaction across departments, between colleagues and between management and workers. Danish manufacturing firms interact with customers and suppliers more frequently than firms in other countries. On the other hand, the interaction with universities is less developed in Denmark than abroad. To a certain degree this reflects a rather well functioning system of technological intermediares who communicate new technological insights to the firms (Christensen, Schibany, Vinding, 2001).

3. Phases of innovation policies

Below is provided an overview of important phases of innovation policies in the past three decades. In some cases it is difficult to differentiate between principles of the broader industrial policy and innovation policy. The overview show that policies have changed from a technology policy to an innovation policy and it shows that different policy principles have been the background for policies in different phases of time. It is subsequently discussed what are the sources of inspiration for the policies pursued.

3.1 The development of innovation policy

Before the 1970s a technology policy was hardly discussed. Only as a part of the general industrial policy and discussions on productivity development the technological development was mentioned as a policy issue. During the 1970s a specific technology policy gradually appeared although it was still not an important part of industrial policy. Instruments used were allowing firms tax deductions for R&D-expenditures, and in 1973 the Law on Technological Service was passed through parliament. This law specified an increased involvement of the Government in the financing and running of the technological assistance to firms. It included the establishment of a Technological Council. In addition to this important policy change a fund was established in 1970 (UdviklingsFondet – the Development Fund), which granted loans to private firms for development of their product- and process innovations and their R&D-expenditures. This Fund fulfilled a need in the industry and was administrated in a non-bureaucratic manner. It lived for an unusual long period, since it was not terminated before 1990. A complementary Fund was established in 1977 (Statstilskud til produktudvikling – Government Subsidy to product development) to fund not only developments of new innovations, but also to fund improvements of existing products in small firms, thus covering more incremental innovations. After a decade in operation this complementary Fund was changed towards supporting firms under establishment. The innovation policy in the 1970s may be character-

ised as somewhat fragmented and based on firm specific subsidies granted on rather general criteria. The growing number of initiatives in the beginning of the 1970s, was to a large extent a reaction on the economic crises.

In the beginning of the 1980s a re-orientation of industrial policies started. The policy was more selective rather than general. It was introduced in some policy instruments that collaboration between a firm and a partner with special knowledge is a prerequisite for a grant. Moreover, it was specifically mentioned in the policy formulation that socio-economic needs were a valid criterion for granting subsidies. In particular the Technology Council (Teknologirådet) was active in this policy formulation, which did meet some resistance from the Industry Associations (IndustriRådet). Also the government became more active in industrial policy although the role of the government was a both-and: on the one hand the new, liberal government, replacing the social democrats in 1982, changed macro-economic policies, including fixed exchange-rate policies. The room for manoeuvre in the economic policy was reduced, as were the available instruments. This made the government look for alternative instruments and to consider the possibilities of using industrial policy. On the other hand, the government were reluctant to be too interventionist in it's approach.

Even before the change of government a re-orientation of the design of policies began. In mid-1980s and to some extent even a couple of years before, there was a rapid increase in the number of different types of subsidies. Moreover, there was a spread of business promotion on several ministries. Especially Ministry of Environment and Ministry of Foreign Affairs increased their share of industrial policy. In 1983 a policy was introduced, which focused upon programmes for stimulating specific generic technologies. Thus, as expenditures for technology policy increased gradually and only marginally, then the expenditures for this programme-policy increased steeply. Important examples include Teknologisk Udviklings Program (Technological Development Programme) from dec.1983, which started the development of this type of policy. It was followed by a bio-tech programme, a programme for developing and using new materials, a programme for Food Technology and a programme on Strategic Research in Environmental Technologies. These programmes have as their main focus to stimulate R&D in selected areas[3]. For example, TUP focused in particular on IT.

This new programme-policy also introduced the incorporation of a wider array of actors in the policy implementation process. Traditionally IndustriRådet and Håndværksrådet (two major industry associations) have had an important say in the formulation and implementation of policy. However, they were only marginally included. In stead, the Association of Electronics Manufacturers was an important player in the TUP-programme.

The new programme-policy was inspired by and resembles those of other countries. For example, programmes in Sweden and the UK on stimulating IT was much alike the Danish TUP-programme. However, the Danish programme took into account a Danish mode of innovation in that it emphasised more the diffusion of technology rather than development of basic technologies. It was also broader in its target industries as it aimed at stimulating the use of IT in traditional industries as well[4].

[3] These programmes were supplemented with a number of other programmes of less R&D-orientation.

[4] One could add that the Danish economy in some manufacturing areas is ill-suited for public procurement policies compared to other countries. Especially Denmark has no strong military complex and not a strong aircraft or space technology industry either. On the other hand a strong and advanced service sector is an advantage in the public procurement policy.

After 1989 and a considerable number of years in the 1990s there was a reduction in the number of subsidies (which exceeded 40 and were beginning to be complicated for the users). In the beginning of 1990s there was even a decrease in the amount spent on industrial and technology policy initiatives. A re-orientation had taken place where research policy gained higher priority relative to industrial policy. This change in policy was inspired by discussions abroad on the inexpedient effects of selective policies be they of the picking the winner or supporting the loser type.

In 1992 it was stated that programme policies would be continued (Industriministeriet, 1992, p.41). However, it was realised soon afterwards, that a re-orientation of policies was needed. Rather than one-sided stimulating the supply-side a different perspective was called for, recognising that a top-down guiding of technological development was useless. Previously, during the phase of programme policy, there was a widespread believe that technological development could be pushed in a top-down planned manner. This perception was abandoned with the shift of policies towards framework conditions. On the initiative of The Danish Business Development Council (EUR) a number of studies were conducted using an approach which resembles that of earlier Porter-studies and similar studies using a cluster approach.

These studies were denoted resource area studies meaning studies of not only private firms in a sector or an aggregation of traditional sectors, but rather an array of different firms, public and private knowledge institutions, suppliers etc. The common denominator defining the resource area is to a large extent the demand for the end product[5]. Moreover, the resource areas are defined as sharing roughly the same factor conditions. The latter point is important, because it means that policies may be targeted towards these areas rather than the traditional statistical aggregation of industries or – as in the programme policies – towards stimulating the generic technologies.

In addition to studies of these areas cross-sectional studies were undertaken. Together these formed the basis for a policy development process. As a follow-up on the analyses it was decided to establish a forum for dialog with representatives from each of the clusters with the purpose of detecting special framework conditions and needs for targeted policies. A reference group consequently monitors each single resource area with representatives from firms, organisations and relevant ministries. Discussions in these groups and ad-hoc working sub-groups help policy makers to identify critical framework conditions and possibilities to improve these. Results of these processes are greater cross-ministerial co-ordination as the resource areas are defined in a broader way than traditional industries and because the framework conditions often involves resorts of Ministry of Education, Ministry of Labour and Ministry of Research[6].

Furthermore there are concrete results of these processes in the form of policy initiatives. In an early 1997 report (Erhvervsfremme Styrelsen, 1997) on the status of the outcome of the process it was found, that 29 ad-hoc working groups have been established, 513 different people from a wide spectrum of organisations, ministries etc. have been involved, 152 policy suggestions (both suggestions to completely new initiatives, changes in existing legislation, changes in administration, changes in priorities in fiscal budgets) were developed, of which 66 were actually implemented.

[5] Examples include Food, Construction and Housing, Medico/Health. See Drejer et al. (1998) and www.ressourceomraader.dk for a further description of the resource areas in Denmark.

[6] In 1993 The Ministy of Industrial Policy Coordination was established. Even the name signalled a broader approach to industrial policy but it also meant a real policy change.

When the Ministry, together with other ministries, in 1996 became engaged in analyses and discussions on the broader aspects of innovation – especially in relation to the work in "Velfærdskommissionen" (Welfare Commission) – focus was extended to especially the intertwined effects of organisational and technological change and to the importance of development of human resources. Recent surveys show consistently that the role of human resources is still more important for the ability of firms to innovate.

Recently another dialog was established between representatives from the businesses and The Ministry of Industry. This was initiated as a response of warnings from industry that long-run competitiveness of businesses were in danger. This was argued to have resulted in a decline in exports (which later showed to be a minor downswing in a long period of increased exports) and should make the Government react, it was argued. As a consequence, a forum for dialogue was established, Industriens Udviklingsgruppe (Industrial Development Group), with representatives from large businesses and The Ministry of Industry. The purpose was to discuss how long-run competitiveness and productivity growth could be ensured.

Although it may be possible to identify such phases of policy, then changes are primarily gradual and some particular instruments are prevailing in more than one period. Moreover, although there may be a certain policy strategy, then the actual implementation process of the policy may considerably modify the original idea.

3.2. Inspiration for recent changes in innovation policies

The sources of inspiration for policy development are naturally a multiple of different types of sources.

The examples above show that inspiration to innovation policy may be spurred by a downswing, which is what traditional, Keynesian policy principles, should advocate - in recessions a need for active industrial policy arises. However, the shift is now not to support the loser, rather to develop national champions and to let policies follow technological waves rather than economic fluctuations.

It is also clear from the examples above that the Danish policy makers have emphasised a direct dialog with the businesses, organisations and even single persons with ideas for policy improvements. This direct dialog is supplemented with various reference groups, which have representatives from industry, either directly from single firms or indirectly from organisations. This dialog between policy makers and business has persisted in Danish innovation policy for a decade.

Throughout this decade there has also been a dialog with academics, and policy makers within The Ministry of Industry have been active in learning what are innovation policy relevant implications of developments in economic theory. Civil servants of Ministry of Industry persistently have kept direct contact to academia with the purpose of learning about new developments in the understanding of innovation. There is, however, still room for further development of ways of communication between academia and policy makers as emphasised by Nyholm et al. (2001, p.270).

Indeed, research in innovation has inspired innovation policy making in Denmark. This goes for various research projects of applied nature. Also policy makers have referred to general develop-

ment of economic theory when arguing for changes in innovation policy. In particular, advances in the system approach to innovation and the evolutionary theory has contributed to a change in the way innovation policy is argued. Some of the policy initiatives and some of the overall formulations of government policies may be characterised as a systems approach. Moreover, the vocabulary is close to what is used in the literature on systems approach to innovation policy. However, when it comes to practical policy it is more ad-hoc based rather than integrated in an overall strategy. Furthermore, most often the causality is that policy initiatives are decided and arguments for the policy are subsequently found in the literature on innovation and the new economy. The traditional market failure perspective as a rationale for policy making has now been abandoned, at least in The Ministry of Industry[7]. In stead, focus is upon the coherence of the innovation system.

The direct contact is complemented with the indirect influence of academia stemming from mainly two sources. First, the content of the education as an economist has changed towards more emphasis on introduction of modern innovation theory. At most universities the students are also introduced to industrial policy, including even innovation policy. Subsequently this means greater awareness of innovation theory when these economists eventually become employed in the central administration. This is probably the most important source of long-run change in policy thinking. Secondly, Danish Ministries have used consultants to undertake large evaluations and similar analyses, but it is usually required that the consultants incorporate leading academics either in reference groups or directly in parts of the work. This is an important way of encapturing in a practical setting the insights from developments of economic theory. The evaluations are, of course, themselves an instrument for policy learning, although they are often not used efficiently as such.

Internally, the Ministry of Industry not only keeps contact to academia but also deliberately upgrade academic skills of policy makers. Thus, civil servants are encouraged to read and write academic papers, and to attend conferences. In the recruitment it is viewed an asset if you have an academic career in advance. Furthermore, an internal Center for Research in Industrial Policy (Center for Erhvervspolitisk Forskning) has been established as well as other similar units for applied research on issues relevant for industrial policy.

One strategy for policy learning within this field is to increase exchange of cross-country experiences. This is already taking place at the level of national civil servants studying innovation policy in other countries. However, the processes are fragmented and to some extend constrained by e.g. language differences. The process could benefit from studies of systematic, research-based foundations. In the Danish Ministry of Industry it is currently being considered how a systematic monitoring of policies in other countries should be organised.

Recent changes in policy are also driven by internal budget constraints. The political system is reluctant to approve permanent expenditures for industrial policy. Therefore, the general change in policy is towards developing more flexible, temporare policy instruments. We shall later get back to this point.

[7] The market failure argument seems to persist in some ministries like The Ministry of Finance and The Ministry of Economic Affairs.

4. Challenges for policy posed by the development of the business environment

The above mentioned increased complexity of innovation is probably one of the most important changes in the way the innovation process is perceived. The increased complexity has several dimensions. Firstly, the focus is now not only on new products and new processes. To an increasing extent it has been recognised that new forms of organisations, augmented services in relation to manufacturing, and development of new after-innovation methods are crucial for economic performance. The way policy makers think about innovation is now broadening from a focus upon manufacturing industry towards innovation in services also.

This is reflected in the intensity and in the way firms collaborate on innovation. Firms tend to innovate in collaboration with other firms and with a broad set of institutions. Moreover, innovations often relate to not only one specific knowledge base. A new food product may for example involve basic knowledge from biotechnology (genetic engineering), chemicals, logistic processes and conservation/packaging. Likewise the ability to innovate is increasingly dependent upon different types of institutions outside research like labour market institutions, education etc[8]. This constitutes a challenge for policy-making, as it requires collaboration between policy makers from different ministries. Often this is not only a clash of different fields of competencies but also of different cultures and approaches to policy making. Despite the fact that innovation policy in Denmark is viewed in a more holistic manner compared to many other countries[9], and there is increased collaboration between ministries there is still a relatively sharp resort-dependent division of policy areas. This is seen a major barrier for a multi-disciplinary innovation policy. To make it even more complicated the rate and mode of innovation in a nation has been said to be dependent upon social capital, which may be difficult to stimulate by way of traditional innovation policy.

Secondly, innovation is not necessarily based upon glamorous, radical new inventions. A wide range of different firms in different industries innovates, although often in an incremental way. Incremental innovations are often embedded in a firm specific setting, and are based upon tacit knowledge. Tacit knowledge, in turn, is not easily transferable as opposed to the increased flows of codified knowledge. At the same time tacit knowledge becomes still more important. This is also a challenge to innovation policy as it highlights the importance of the regional dimension of policy making. In spite of increasing internationalisation, innovation policy is still important in a national and even regional context (Lundvall & Borras, 1997).

Thirdly, the above mentioned increased tendency to collaborate on innovation makes policies to stimulate collaboration even more central in the future (this is exemplified later). In many countries special attention is paid to stimulating knowledge transfer from knowledge institutions to private firms. In Denmark, as well as in many other countries, the re-orientation of innovation policy has meant a movement from firm-specific subsidies to supporting institutions collaborating with firms.

Fourthly, the development is characterised by turbulent, fast changes, which in itself makes innovation policy more difficult. This makes it more necessary to closely monitor the development and to

[8] Recently The Ministry has attempted to integrate industrial policy with the development of culture. This is reflected in a joint publication from The Ministry of Industry and Ministry of Culture in which it is argued that there is a strong link between industrial development and culture (Erhvervs- og Kulturministeriet, 2000).

[9] This is reflected in the strategy for industrial policy published in 2000 (Regeringen 2000a and 2000b).

develop flexible, temporary policy instruments. For example, the Danish government has implemented a monitoring exercise, where key indicators on innovation etc. are benchmarked against other countries. Furthermore, the Government has decided to implement during 2001-2003 an account on national competence development (Regeringen, 2000, p. 24). Official statistical data are, however, often rather old when they are released, and often the data are not focused upon indicators reflecting the new economy. Therefore, dialog with leading-edge firms and knowledge institutions is essential. With respect to flexibility the ambition with development of policy is to a greater extent use a temporarily stimulation of market forces by providing incentives to make the markets function, then pull out of the market.

Fifthly, as information is generally available, and as all countries try to set up the best possible general framework conditions, the critical success factor increasingly becomes to develop specific framework conditions, which may be useful for only a segment of the market and which may be more "soft" factors.

Finally, the systems approach to innovation policy advocates focus upon the coherence of the system and the ability of institutions to upgrade the learning capacity of firms. However, in order for this policy to be successful, it is a prerequisite that competencies of consultants, of investors in new firms, of potential entrepreneurs and managers are sufficient to render a fruitful collaboration. In other words, the absorptive ability of firms to incorporate new knowledge is dependent upon the competence of the parties. Therefore, a general increase of competencies will make innovation policy more efficient. This is, however, a difficult policy area, and considerable creativity in policy making is called for. One response on this challenge is the Danish LOK-programme (LOK=Management, Organisation and Competence)[10], which was heavily inspired by academic research in the Danish innovation system.

5. Selected examples of innovation policies – principles for policy making

5.1. Policies aimed at improving the risk capital market

It is obvious that availability of capital is only part of a well-functioning national innovation system. It is, however, an important part and it has been claimed that financial institutions to a large extent is the glue in national innovation systems as they bind together different types of agents in the NIS and are the selection mechanisms of business opportunities. Likewise it is important to have a wide range of adequate institutions within the financial system to perform this selection in a competent manner.

A number of government initiatives have aimed to fill in what is perceived as gaps in the financing of firms[11]. The intention behind the design of these initiatives is that they should each contribute to the improvement of access to capital in different stages of the development of a firm.

[10] See further details on this programme in Lundvall & Borras (1997, p.98) or http://www.lok-initiativer.dk/

[11] Among initiatives taken in recent years the following should be mentioned: a guarantee scheme for selected venture capital companies, a fund "Danish Business Development Finance", a Loan Guarantee Scheme, a specialised institute to

Government initiatives and the private market driven development have no doubt contributed to a narrowing of the financing gap mentioned earlier. There are further plans or already taken actions within the government to improve access to finance including establishment of a business angels network and changes in the legislative regulation of investments from pension funds.

In general, broadly all initiatives are inspired from similar schemes in other countries. A similar approach is taken in other countries as well: inspiration to policy formulation on risk capital comes to a large extent from abroad[12], but also through dialogue with suppliers of capital and with academics. Interestingly, ideas within this area have a considerable entry time. For example, a business angel network was proposed in 1992 (Koppel, 1992), a loan guarantee scheme in 1992 (Christensen, 1992), mezzanine capital in 1992 (Christensen 1992). This is not to say that it was unwise to not implement these schemes earlier. Rather, it shows two things. It shows that the policy process is a balance between interests – in this case the agents on the market have been very conservative and reluctant towards changes that are not purely market driven. And it shows that the timing of government initiatives is crucial. What may be politically feasible and work in practise in one period may be functioning very differently in another period of time. The market may in many cases need certain maturity before private agents adopt policy initiatives.

The above target of policies illustrates two of the general policy principles derived from this case. First, innovation policy is most often targeted towards a specific segment of the industry rather than general, macro policies. It is a very clear picture from government programmes that they are primarily targeted towards the seed- or early stage segment. Secondly, the need for policy intervention is as dynamic as the development of the business environment. Therefore, the need for innovation policy depends upon the business cycle and the structural development in general. Furthermore, the effectiveness of innovation policy may be dependent upon the timing and structural development. In addition to these two principles we may add a third principle, which has guided policy in particular in the risk capital market area but increasingly also other policy areas: the strategy of the policy intervention is to either give the private market forces a spark, then pull out as soon as the private agents have established a sustainable market. The strategy may also be to subsidise costs associated with learning to operate in a segment of the market where learning costs prevent private agents to operate profitable. The very early, seed funding of entrepreneurial businesses is one such market. In pursuing this strategy it is recognised that direct government participation may in some cases lead to government failure: even if the private market is not capable to solve a certain problem, then there is no guarantee that the government is any better. Therefore, the strategy for policy is to build upon competencies already existing in the market. In some cases, however, there is no argument why government intervention should not be equally, or more, efficient than private agents.

5.2 Policies to stimulate collaboration on innovation

The importance of collaboration, co-operation and networking (ccn) in innovation has been much emphasised in recent economic thinking as well as in empirical work on innovation. Since long it

provide Mezzanine capital, Tax changes, Establishment of 6 business incubators. See more on these initiatives in Christensen (2000a).

[12] See a review of government initiatives to stimulate venture capital in OECD countries in Financial Market Trends, no. 63.

has been recognised that firms rely heavily upon external partners in innovation activities. However, it is now widely believed that recent changes in the economy as a whole and more specifically in the way innovations are undertaken, has meant an enhanced role for ccn in innovation as was also pointed out in section 3. It is reasonable to expect this trend to continue and be reinforced in the future. The arguments for this are several. It should here only be pointed to the fact that production is increasingly dependent upon knowledge, but not just any knowledge. Economists and sociologists alike have come to the agreement that tacit knowledge is becoming still more important. This is in turn caused partly by the wide, easy access to information in general. When everybody have access to codified knowledge, then a leading edge in the competition must depend upon a unique knowledge not as easily accessible by others; it must depend on tacit knowledge. Tacit knowledge is, however, rarely produced in isolation and it is above all transferred in an interaction with the user of this information. Therefore, collaboration on developing and transferring useful knowledge for innovation is likely to increase.

Given the fact that ccn is key in tomorrows industrial development, it becomes interesting to know how ccn is stimulated. In other words, this becomes a major policy issue. Following the argument above an example on Danish policies targeted at stimulating ccn is presented. The case, Centerkontrakter (Centre Contracts) is a scheme designed to enhance collaboration between universities, semi-public research institutions and industry. All three types of parties must take part and it is explicitly formulated that long-term competence building and innovation is one of the major objectives. This scheme may be seen as giving incentives to backward linking with knowledge institutions and it is heavily oriented towards *development* of relatively radical innovations. This scheme is seen as an important new instrument in Danish innovation policy.

As was discussed earlier, it has been a general trend in Danish innovation policy to turn focus away from single, isolated elements of the conditions for innovation, and in stead enhancing the coherence of the different elements in the innovation system. The Centrecontract-scheme is an important example on such policies as it gives incentives to bring together key actors in the system. Thus, the objective of the Centrecontract-scheme is to intensify the corporation between universities, private companies and the Authorised technological service institutes.

The Centrecontract-scheme was introduced in 1995 and is basically a government co-financing of the costs of Authorised Technological Service Institutes (up to 75%) and research institutions (up to 100%) in participating in a strategic collaboration with private firms on process or product development.

The Authorised Technological Service Institutes are not only the key ccn-partner and driving force behind establishment of the majority of Centre contracts, but also important intermediaries in the general knowledge transfer in the economy. Generally the intermediares are important institutions in Danish innovation system.

The aim with the scheme is that the specific impact should be three-fold: First, an (expected) effect on innovation. Second, the aim with the scheme is to increase competencies, especially in the GTS-institutes. The third effect expected from the scheme is a pure network effect. It is explicitly formulated that the scheme is intended to stimulate networking among the partners not only during the centre contract but also on a longer term. One of the sub-objectives of the programme is to transfer tacit knowledge.

Generally the scheme is an adequate measure for bridging different elements in the innovation- and knowledge system. It is often a problem to ensure productive collaboration between different types of partners because they have different incentives[13]. Evaluations have shown that the centre-contract scheme is an effective means of ensuring incentive compatibility and facilitating the transfer of knowledge between different parts of the innovation system. The success of this instrument has meant a tendency to over-use it on many policy problems.

The above policy example show that ccn-policy has high priority in Danish innovation policy. The Danish firms tend to collaborate relatively often when developing new products although (due to the institutional structure of the innovation system) not as often directly with universities. Probably, this over-average propensity to collaborate is rooted in a historical tradition for informal, trust-based collaboration, perhaps even stemming back to the co-operative movement in the beginning of 20th century. An additional explanation is the tradition for corporatism on the labour market.

6. Conclusions

This paper outlined different phases of Danish innovation policies. Although changes have been gradual there were a clear movement from firm-specific subsidies to programme policy and subsequently to gearing framework conditions for targeted areas of industry. In recent years the system approach to innovation policy has been important. Innovation policies now emphasise the coherence of the system, knowledge flows, competence building and ccn.

The inspiration for this change of policy has come from a multiple of sources. The policy formulation has been inspired by a combination of foreign programmes, single private firms, organisations and academia. Both international and domestic sources of inspiration for policy change have been important. Thus, the OECD has on some points inspired policy making as has both the general policy strategies of other countries as well as specific programmes. To some extent economic theory and researchers in other countries have inspired policy making, but probably the domestic sources are more predominant in Denmark than in other countries, even if Denmark is a small country.

Moreover, the development of the business environment has meant a dynamic pressure on the innovation policy formulation. Specifically, increased complexity and speed of the innovation process has challenged policy formulation. In addition, a broader perception of what is innovation and an increased collaboration between different actors makes innovation much broader than hitherto perceived. This means in turn involvement of a wider range of policy actors.

Reactions to these trends are necessary because the need for policy intervention is as dynamic as the development of the business environment. Therefore, the need for innovation policy depends upon the business cycle and the structural development in general. There are several policy changes as response to these challenges. One strategy of policy intervention is to support the private market forces for a period of time, then pull out as soon as the private agents have established a sustainable market. This is at the same time a means of having flexible instruments and a way of avoiding negotiating for permanent expenditures, which the political system is reluctant to approve. Among the policy principles is also to bind together different elements of the innovation system. This involves a high priority to ccn-policies as a means of diffusing knowledge in the innovation system. An im-

[13] These differences are well described in the literature on university-industry collaboration.

portant element in the strategy to increase knowledge flows is to upgrade competencies through interactive learning. With respect to policy learning the direct dialogue with leading edge firms is important, as is the monitoring of the development.

Recent discussion on Danish innovation policy takes into account the distinction between tacit and codified knowledge as part of developing special framework conditions and selective policies. This debate is inspired by the cluster thinking which has since long been a tradition in Danish innovation policy[14]. Competence building in regional[15] agglomerations is seen as still more important in future industrial development.

[14] In the 1980s a number of studies analysed complexes in the Danish economy such as the agro-food complex.
[15] In fact a rather small share of industrial policy in Denmark is regional.

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